REMARKS/ARGUMENTS

Reconsideration of this patent application is respectfully requested in view of the foregoing amendments, and the following remarks. Claims 7-12 are in the application. Claims 7 and 9 have been amended. No new matter has been added.

The Examiner objected to claim 7 for some typing errors, and rejected claim 9 for depending from a canceled claim. Applicants have amended claims 7 and 9 accordingly.

The Examiner rejected claim 7 under 35 U.S.C. §112, stating that it was unclear whether the term "hydrogen" referred to the partial hydrogen stream or the final pure product. Applicants have amended claim 7 to clarify that the partial hydrogen stream is intended.

The Examiner rejected claims 7-12 under 35 U.S.C. 103(a) as being unpatentable over *Fuderer U.S. Patent No. 4,553,981* in view of *Engler et al. U.S. Patent No. 7,452,393.* Applicants respectfully traverse.

Claim 7 has also been amended to clarify that the amount of the partial hydrogen stream is adjusted during the production of hydrogen in the steady-state operation. Support for this amendment can be found in the specification in the paragraph beginning at the bottom of page 6 and ending in the middle of page 8.

The present invention in claim 7 relates to a method for extracting hydrogen from a gas that contains methane, comprising catalytically splitting hydrocarbon contained in the gas into hydrogen, carbon monoxide, and carbon dioxide in a reformer by means of steam; performing catalytic conversion of the carbon monoxide that was formed to carbon dioxide and hydrogen in a subsequent conversion stage, with steam; removing the carbon dioxide after the step of catalytic conversion by means of a gas scrubber; subsequently separating the remaining gas stream into a product gas stream that consists of hydrogen, and a waste gas stream, in a pressure swing adsorption system.

According to the present invention, the entire waste gas stream is passed to a combustion chamber of the reformer, together with a partial hydrogen stream that is branched off from the gas behind the gas scrubber, as a combustion gas that is extensively

free of carbon, and burning the waste gas stream and that partial hydrogen stream in the reformer, wherein during the production of hydrogen in the steady-state operation the amount of the partial hydrogen stream is adjusted so that the partial hydrogen stream meets an energy demand of the reformer during common combustion with the waste gas stream.

Because of the method according to the invention, additional firing of the reformer in the steady-state operation with fuels that contain carbon is eliminated, so that the carbon dioxide emission is clearly reduced.

As discussed in the previous response, the method according to the invention differs considerably from the method of *Fuderer*. Even a combination of the method disclosed by *Fuderer* with the method disclosed by *Engler* does not lead the person skilled in the art to the claimed invention.

With respect to the installation for hydrogen production and the method for using the same disclosed by *Engler*, Applicants submit that a prior art reference must be considered in its entirety, i.e., as a whole, including portions that would lead away

from the claimed invention (MPEP 2141.02 VI). Furthermore the proposed modification cannot change the principle of operation of a reference. If the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims prima facie obvious (MPEP 2143.01 VI).

According to the abstract, *Engler* relates to an installation and process for producing hydrogen, wherein additional equipment is provided in order to continue operation in the event of a purification unit shut down. Hence, *Engler* relates to an auxiliary operation of the installation and process.

Fig. 1 of *Engler* shows an arrangement comprising a reforming unit 1, a conversion reactor 3 and a purification unit 4 to extract the hydrogen produced through line 20. According to the setup disclosed in fig. 1, comprising a reforming unit 1 and a conversion reactor 3, a separation of carbon dioxide is not provided so that the carbon dioxide is contained in the waste gas which is fed to the burners 6 of the reforming unit 1. According to the embodiment shown in fig. 1, the whole amount of carbon

dioxide is released into the environment. An additional line 11 connects the line 5 downstream with respect to the conversion reactor 3 and upstream with respect to the purification unit 4 with line 9 which is connected to the burners 6, wherein a valve 18 is provided in the additional line 17. According to col. 4, lines 39-40, valve 18 is closed in steady-state operation, so that the burners 6 only burn waste gas and auxiliary natural gas. According to col. 4, lines 43-56, valve 18 is only opened in the event of a sudden and unscheduled shutdown of the purification unit that is automatically isolated from the rest of the installation, wherein the buffer tank is no longer supplied with waste gas. This means that the additional line 17 is only provided for an auxiliary operation, wherein valve 18 is only opened in case that no hydrogen is produced due to the unscheduled shutdown of the purification unit 4.

The same mode of operation is provided for the installation shown in fig. 2. This installation comprises two additional lines 29, 117 comprising valves 30, 118. In the steady-state operation, valves 118 and 30 are closed and the installation is in conventional operation which is known per se (col. 6, lines 22-24). According to col. 6, lines 25 ff. the valves 118 and 30 are only

opened in the event of a sudden and unscheduled shutdown of the purification unit, so that no hydrogen is produced when the valves are opened.

In the steady-state operation, the burners 6, 106 are supplied with waste gas and auxiliary natural gas. It is not suggested to mix the waste gas stream, i.e. the total waste gas stream, with a partial hydrogen stream branched off from the gas stream behind the gas scrubber in the steady-state operation, wherein the amount of the partial hydrogen stream is adjusted so that it covers the energy demand of the reformer during common combustion.

Even if the person skilled in the art would combine the teachings of *Fuderer* and *Engler et al.*, the mode of operation in the steady-state would not change with respect to the method according to *Fuderer*. Additional bypass lines would be provided only for an auxiliary operation in case of a sudden an unscheduled shutdown of the purification unit. Even under consideration of the combination of *Fuderer* and *Engler et al.* it is not suggested to supply the reformer with fuels that do not contain carbon or carbon dioxide in the steady-state operation. It is not suggested to

adjust the amount of a partial hydrogen stream in the steady-state operation so that it covers the energy demand of the reformer during common combustion with the waste gas stream. It is emphasized that the present invention is based on another mode of operation with respect to the cited prior art.

Furthermore, the embodiments disclosed by *Engler et al.* (fig. 1 and fig. 2) relate two different methods and setups. A liberal combination of single features of both installations without consideration the respective mode of operation is not appropriate. According to fig. 1 of *Engler et al.*, the installation comprises a reforming unit 1 and a conversion reactor 3, but a removal of carbon dioxide is not provided. Accordingly the whole amount of carbon dioxide is fed to the burners 6 regardless of the setting of valve 18. With respect to the embodiment shown in fig. 2, it is not provided to convert carbon monoxide to carbon dioxide. Instead, carbon monoxide is separated from the gas stream as a process product. The removal of carbon dioxide is provided directly after the reforming unit, wherein the gas stream still contains a large amount of carbon monoxide. Even if a down stream conversion of carbon monoxide would be provided, the waste gas stream would comprise a significant amount of carbon

dioxide due to conversion. Hence, it is not justified to combine isolated features of the two embodiments disclosed by *Engler et al.* with the method disclosed by *Fuderer*.

As the present invention is based on another mode of operation, there is no suggestion in the cited references to provide a system for extracting hydrogen according to claim 10 of the subject under examination. It is especially not suggested in either of the references to provide an additional device for passing back part of the hydrogen-gas stream that leaves the gas scrubber into the combustion chamber of the reformer, wherein the system also comprises at least one reformer and a conversion stage.

Accordingly, Applicants submit that claims 7-12 are patentable over the cited references, taken either singly or in combination. Early allowance of the amended claims is respectfully requested.

Respectfully submitted,
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